

# Impacts of Climate Change on Ocean Dynamics

Introduction	Climate Factors and Marine Species	Arctic Sea Ice Extent and Melt	Marine Heat Waves
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## Analyzing the Connection Between Ocean Dynamics and Climate Change

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### **Topic 1: Climate Factors and Marine Species Shifts**

- Which marine species appear to be most affected by sea level change?
- Which marine species have shown the most movement?
- Are there detectable changes to marine species migration patterns in the U.S.?

### **Topic 2: Examining Sea Ice Extent and Melt Season**

- Does the extent of Arctic sea ice impact its melt season?
- What sea ice ages have seen the lowest ice extent at the end of their melt seasons in September?
- How has the duration of Arctic sea ice melt seasons between March and September evolved over the years?

### **Topic 3: Duration, Severity, and Regional Impact of Marine Heat Waves**

- How have severe marine heat wave events changed over time between different U.S. coastal regions?
- Which marine protected areas experienced the most intense marine heat wave impacts between 2018 and 2023?
- How has the duration of marine heat wave events evolved over time, and which severity levels are most dominant across regions?

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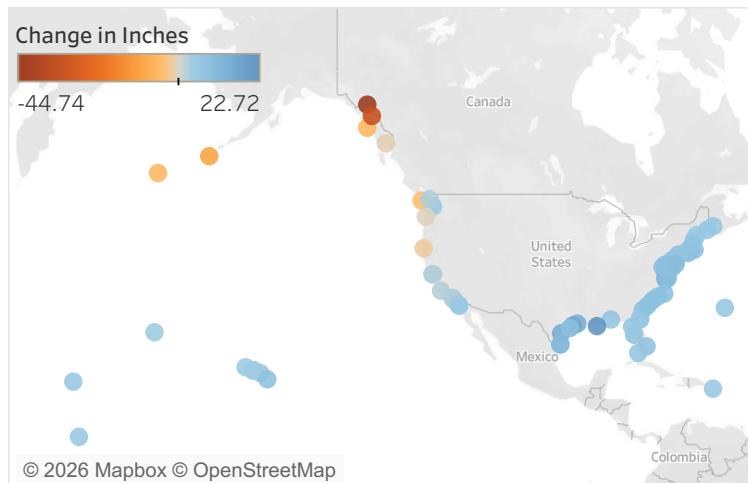
Introduction

Climate Factors and Marine Species

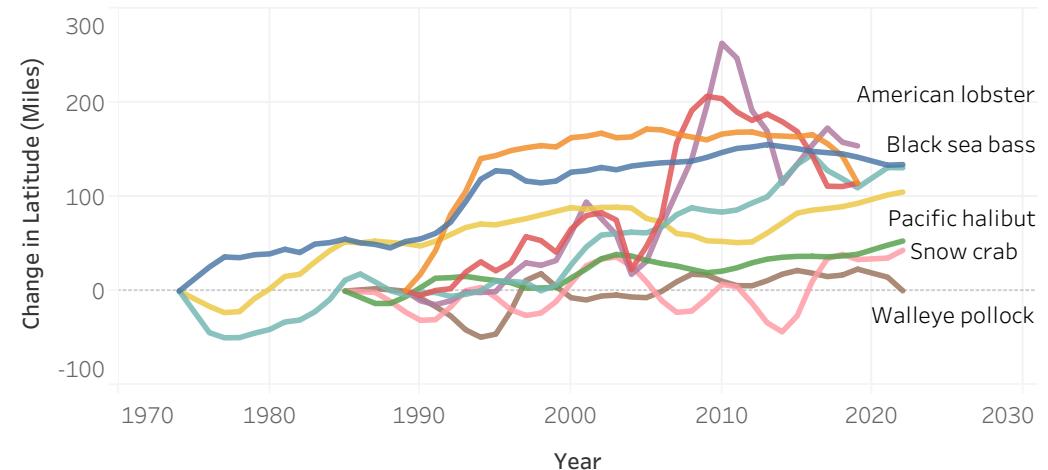
Arctic Sea Ice Extent and Melt

Marine Heat Waves

Sea Level Change from 1960-2023



Change in Latitude by Species



Species Migration Patterns in the U.S. in 1992



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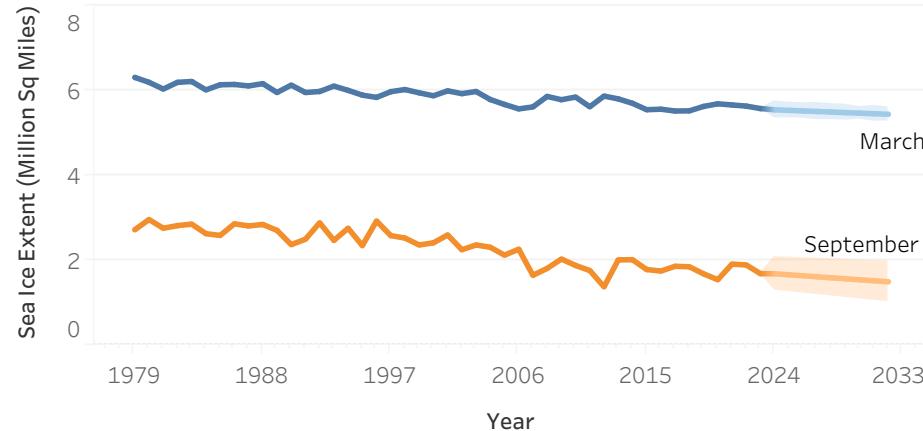
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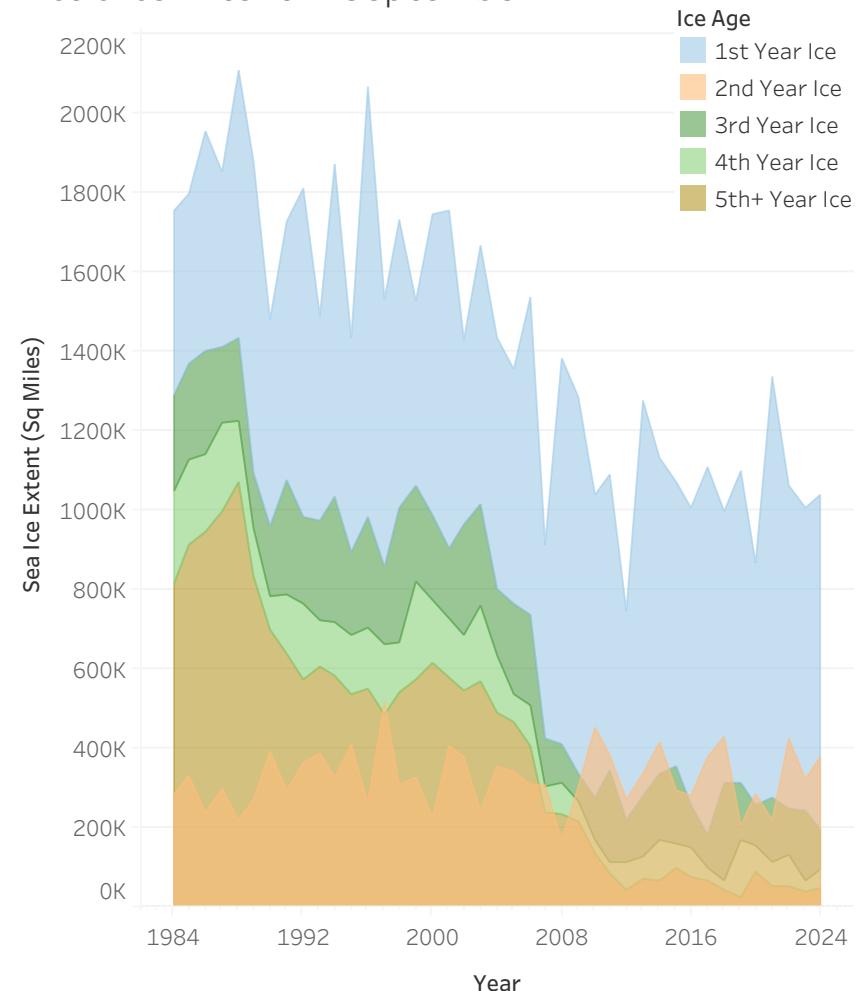
Arctic Sea Ice Extent and Melt

Marine Heat Waves

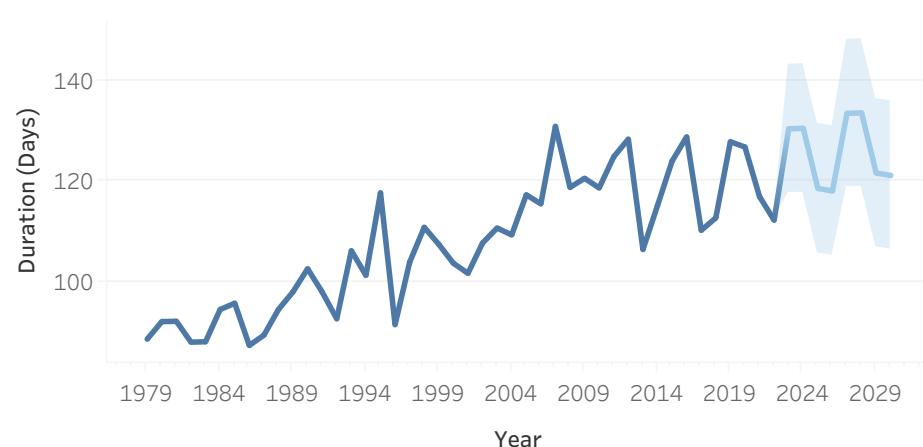
Arctic Ice Extent Monthly Average



Arctic Ice Extent in September



Arctic Ice Melt Season Duration



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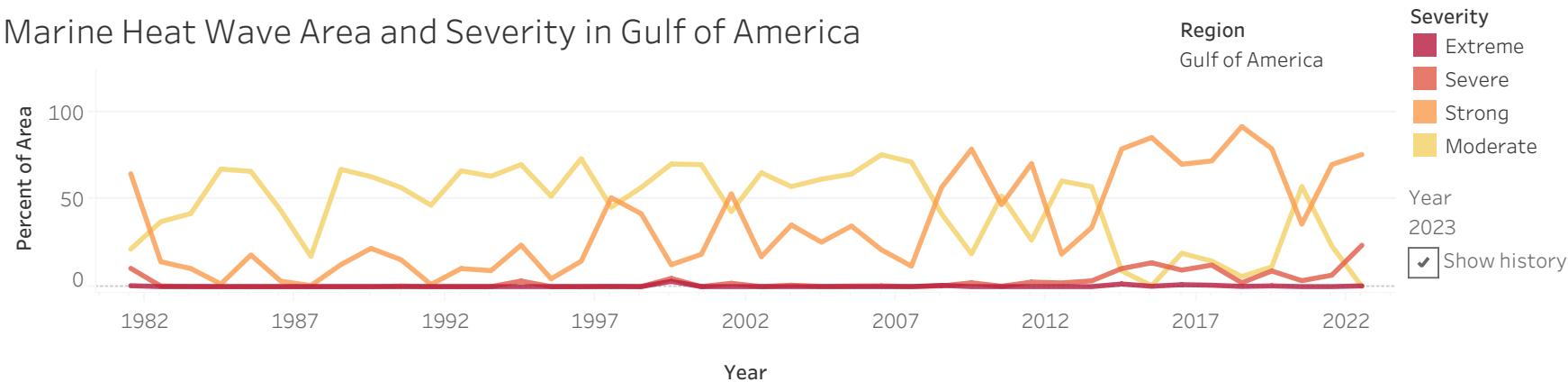
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Climate Factors and Marine Species

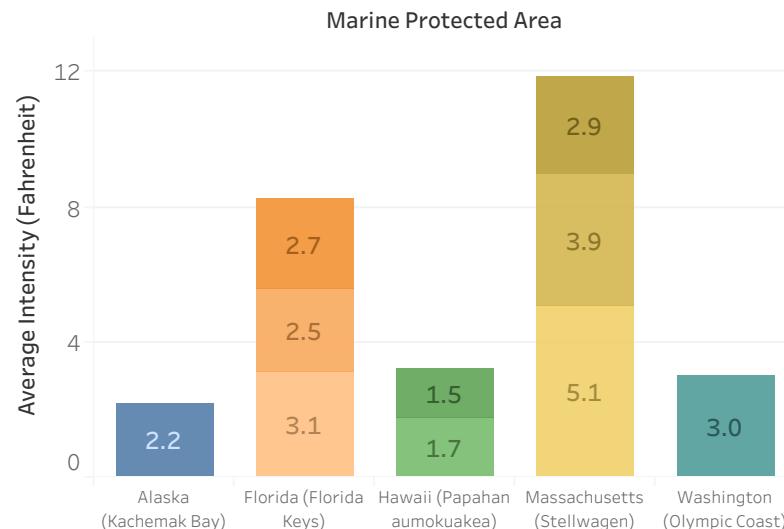
Arctic Sea Ice Extent and Melt

Marine Heat Waves

Marine Heat Wave Area and Severity in Gulf of America



Change in Heat Wave Intensity in 2023



Heat Wave Duration in Washington (Olympic Coast)

